On the life colours and nuptial tubercles of Oreodaimon quathlambae (Barnard, 1938) (Pisces, Cyprinidae)

by

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INTRODUCTION

There have been several papers in recent years concerning the rare and unique cyprinid fish *Oreodaimon quathlambae*. Although Greenwood and Jubb (1967) have given a detailed account of the morphology and osteology of the species, certain aspects remain outstanding. In the original description, Barnard (1938) noted the colour of the preserved fish and also the fact that conical tubercles occurred on the head in both sexes. Both these aspects were poorly described and have not since been elaborated on.

In January 1973, several specimens of *O. quathlambae* were collected by the writer whilst on a trip to the Sehlaba-Thebe Wildlife Sanctuary and National Park, Lesotho. A colour description has been prepared from colour transparencies, and notes taken from the living and freshly killed fish. Some of the specimens exhibited relatively well-developed nuptial tubercles, and in view of the doubtful relationships of *O. quathlambae* (Greenwood and Jubb 1967) a record of the tuberculation is therefore presented here.

MATERIALS AND METHODS

All the specimens are from the Tsoelikana River, south-east Lesotho, where the only known extant population of *O. quathlambae* exists. (Recent searches for the species in the type locality, the Umkomazana River, Natal, have not yielded specimens). Six specimens were sent to the Albany Museum by Mr T. Pike of the Natal Parks Board, a co-collector with Mr A. J. Tedder the Fisheries Officer for Lesotho. One of these specimens was collected in November 1970, and the other five in April 1972. A further seven were caught by the writer in January 1973. The fish were collected either by means of an electric shocker (Pike and Tedder) or with a 6 meter "anchovy mesh" minnow seine.

Colour transparencies and notes were made of the living and freshly-killed fish for the colour description. The nuptial tubercles were studied by means of a conventional M5 Wild Stereo Microscope and a JEOL JSM U3 Scanning Electron Microscope.

LIFE COLOURS

Figure 1 shows four specimens of *O. quathlambae* shortly after being killed in 10% formalin. The top three fish are females and the fourth is a male. Degree of pigmentation is the only noticeable sexual difference in respect of colouration.

Viewed from above, the dorsal surface is of a uniform dirty olive-brown (bluish-olive in breeding males, Figure 2), with scattered dark spots, of about 1,5 mm diameter, on the body. In certain fish these spots are arranged more regularly, in two or three, longitudinal rows.

FIGURES 1—6. Showing life colours and aspects of nuptial tubercles of *Oreodaimon quathlambae*.

Fig. 1. From the top, three females and a male *O. quathlambae*. Tsoelikana River, Lesotho, January 1973.

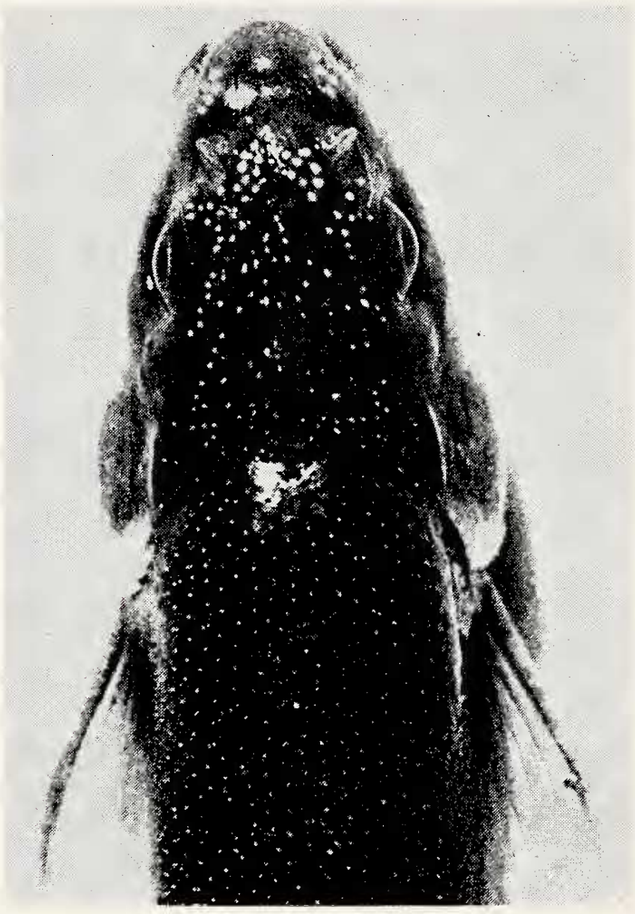

Fig. 2. Dorsal surface of male with nuptial tubercles.

There is considerable variation in the number of spots per individual—from about 15 to 57 with an average of between 30 to 35. In some fish small whitish patches occur at the anterior and posterior edges of the dorsal fin base. In males with tubercles, those on the head and scales produce a fine spotted effect, emphasized by the deep pigmentation of these individuals (Figure 2).

The dark lateral band evident in preserved material (Barnard 1938) is seldom so evident in living fish. In only one of the seven live fish observed by the writer was this an obvious feature. The band, obvious or faint, was found to be broken into a series of dashes, with no posterior expansion on the caudal peduncle. Thus, in this respect, the fishes studied here appear to differ from the description given by Barnard (1938) for this band to "end as a spot" on the caudal peduncle.

The lateral line forms an approximate limit between counter-shaded dorsal and the lighter lower surface (Figure 1). Proceeding from the countershade the colour passes through a pale golden tinged olive to a blemished silvery white and finally a brilliant white on the belly.

On the head the dorsal countershading encompasses the eye and the dorsal half of the opercular area. The operculum has an underlying golden green iridescence. The ventral surface of the head is brilliant white from below a line extending from above the angle of the mouth around and below the eye and across the operculum.

Bright orange-red flashes occur in the axils of the pectoral and ventral fins and laterally along the base of the anal fin. Figure 1 shows the extent of development of these flashes. The flashes are rather sharply demarcated and are not placed on the fins themselves. The fins are however, faintly flushed towards the anterior basal angles. The flash in the region of the ventral fins dorsally circumscribes the base of each fin and crosses the ventral surface of the body just posterior to the bases of the fins. The anal fin flash is a narrow lateral band on either side of the base of the fin. The dorsal and caudal fins are pigmented a chocolate brown, darker at their bases and lighter at their outer edges.

The eye has a bright silver iris with a round black pupil.

NUPTIAL TUBERCLES

Barnard (1938) noted that mature specimens of both sexes of *O. quathlambae*, in ripe condition, had warts or tubercles on the dorsal surface of the head. Examination of the present material showed that the tubercles were not limited to the dorsal surface of the head and as the distribution of nuptial tubercles is of systematic importance (Wiley and Collette 1970) a more detailed record of their distribution and development has been prepared.

The classification of developmental stages of nuptial tubercles applied as by Lachner and Jenkins (1971) to the genus *Nocomis* is used in this description. The developmental stages are categorized by these authors as follows: spots: small, round, light to grey areas in the deeper epidermis; buds: small pimples having round to pointed tips; tubercles: the completed growth stage following budding, i.e., hard, cornified structures that attain their greatest development more or less synchronously with the (spring) reproductive period of the mature males; tubercle scars: shallow to moderately deep, discoloured cavities resulting from the loss of the nuptial tubercle.

Two of the seven specimens caught in January 1973 were males showing relatively well developed nuptial tubercles. Males caught in April 1972 showed development of spots and buds on the posterior dorsal surface. In these latter specimens there is no tubercle development on the scales or fins. Females caught in April 1972 show no tubercle development; however, those caught in January 1973 minute tubercles are present on the head and scales. These are perhaps best classified as buds for although barely visible to the naked eye, microscopical

examination shows them to have a conical structure. There is no tubercle development on the fins of any of the females examined.

The following account of the distribution and development of nuptial tubercles in *O. quathlambae* is taken from the two tubercule-bearing males caught in January 1973. Figure 2 shows a dorsal view of the larger of the two specimens. The distribution of tubercles for these specimens is as follows:

Head: A group of four to five well-developed tubercles is present anterior to each nostril in the larger specimen. On the dorsal area enclosed by a line between the nostrils, the supra-orbital canal and postocular commissure of the cephalic lateral line system and the posterior margin of the head, the tubercles are scattered more or less in groups. There are also a few scattered tubercles along the posterior and postero-ventral border of the preoperculum and latero-ventrally on the operculum.

Body: Tubercles are found on all the scales (Figures 2, 4). There is usually only one tubercle per scale but two or three may also be encountered, particularly in the area just anterior to the dorsal fin. Tubercles also occur on the scales of females.

Fins: On the pectoral fins there are bands of tubercles (figure 5) overlying all except the leading fin ray. In depth each band contains up to six tubercles but the numbers diminish towards the ends of the bands with a corresponding tapering effect. The bands begin soon after the ray emerges from the axil and do not reach the outer border of the fin. The tubercle bands are on the dorsal side of the fin only. Tubercles also occur on the dorsal, ventral and caudal fins. Both surfaces of these fins have tubercles but in the paired ventral fins development is more pronounced on the dorsal surface. Generally, a single row of tubercles is found overlying each finray, this row dividing with the ray. Tubercle development on the caudal fin is relatively minor.

Size: Size was measured from the electron micrographs and in the case of the larger tubercles with fine calipers under the stereo microscope. The largest tubercles measured are those on the antero-dorsal surface of the head in the larger of the two male specimens. These are up to 0,4 mm across the base with an equal height. Figure 3 shows an average-sized tubercle 0,12 mm across the base. Scale tubercles (figure 4) are smaller, averaging 0,07 mm in basal diameter.

On the pectoral fins the bands of tubercles measure up to 0,25 mm in width (Figure 5). Those nearest the leading edge of the fin in each band are the largest in that band. Band tubercles are laterally compressed for more efficient accommodation in rows (Figure 5). Along the long axis of the base the largest band tubercles measure approximately 0,12 mm. The tubercles along the trailing edge of the band are a third to a half the size of the leading edge tubercles, i.e., approximately 0,05 mm along the long basal axis.

Development: Males collected in April 1972 show minor tubercle development. Spots and buds are present on the posterior dorsal part of the head. There are no obvious scars, no sign of tubercle development on the scales or fins. Of two females collected at the same time one has spots on the dorsal head surface.

A female collected in November 1970 has buds or small tubercles on the head and there is microscopic tubercle development on the scales. All five females collected in January 1973 have buds or small tubercles on the head and three of the five have scale tubercles.

The development of the tubercles of the two males caught in January 1973 varies considerably. The two specimens measure 85 and 72 mm (standard length) respectively, indicative of at least a year class difference. The pattern and development of the tubercles of the larger specimen is shown in Figure 2. In this specimen the head tubercles are best developed anteriorly. In the second the head tubercles are located on the posterior dorsal surface, and there are no tubercles on the snout.

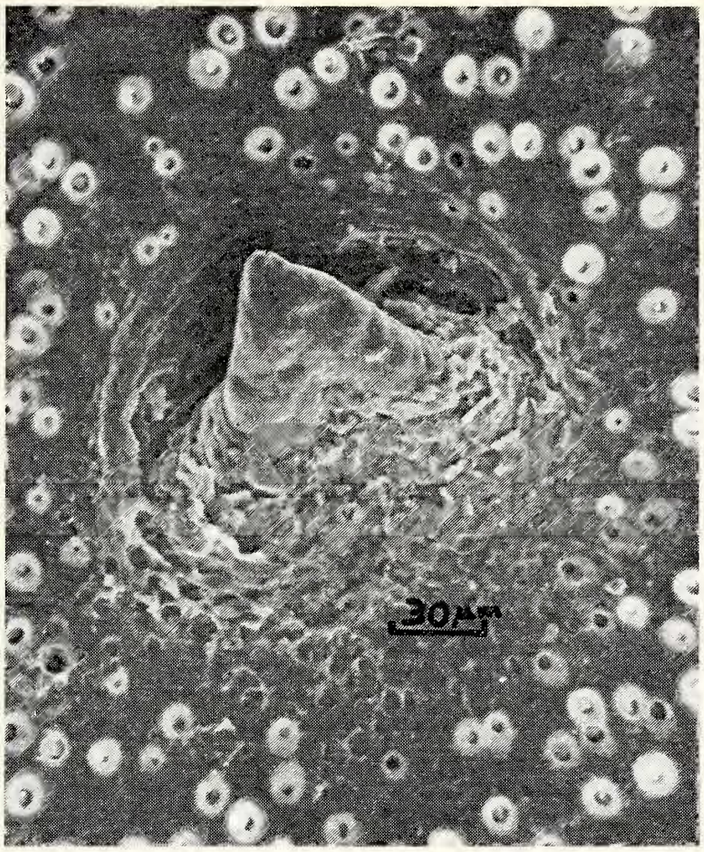

Fig. 3. Scanning Electron micrograph of male head tubercle (partially collapsed in preparation)

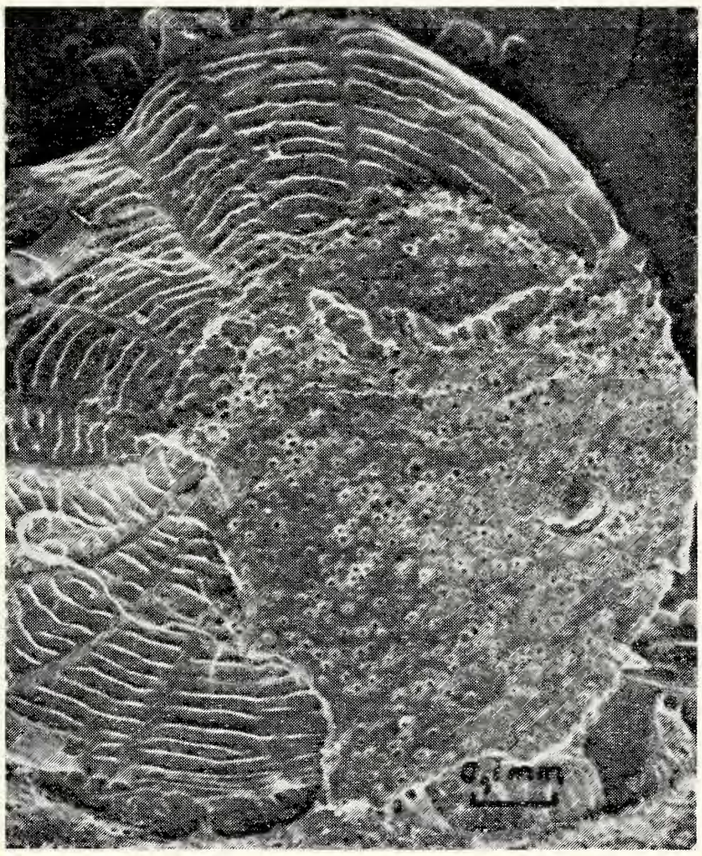

Fig. 4. Scale tubercle (male).

Fig. 5. Band of tubercles from right hand pectoral fin.

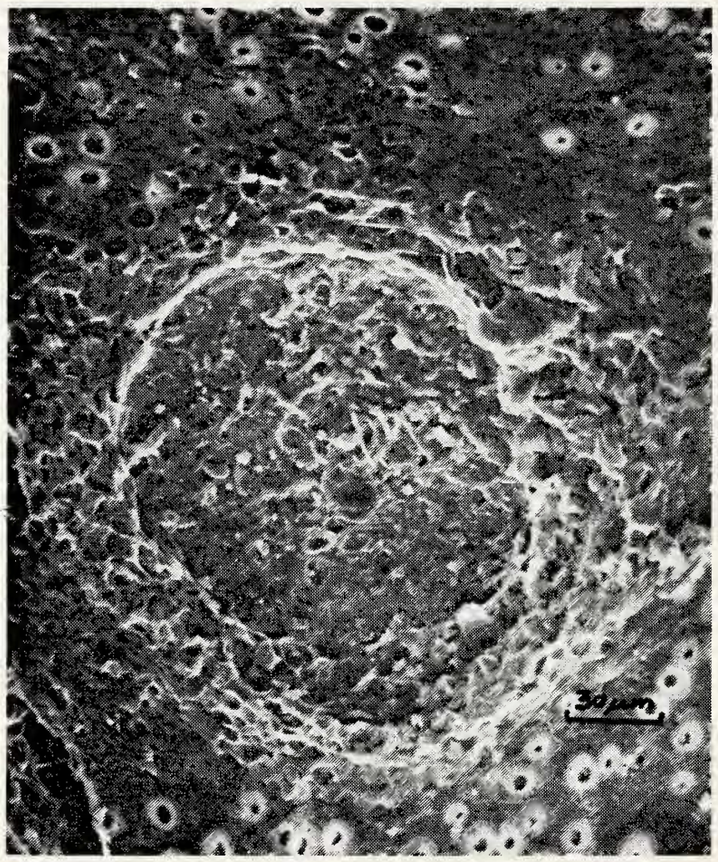

Fig. 6. Male head tubercle scar.

The head tubercles of the smaller male measure up to 0,12 mm in diameter of the base—considerable less than that of the larger fish (cf. above). This indicates an agreement with the findings of Lachner and Jenkins (1971) where in certain species of *Nocomis* there is an increase in tubercle number and size with increased length of fish.

An interesting finding is that scars (Figure 6) are more common on the smaller male. The gonads of the larger male are relatively better developed than those of the smaller. Catching operations may be responsible for the greater number of scars of the smaller fish but it is also possible that this specimen, caught about four kilometres upstream from the larger one, might have already partially milted. The implications being that the seasonal, but not absolute, development of tubercles in the smaller individual was more advanced.

GENERAL

Wiley and Collette (1970) have pointed out how functionally significant structures like nuptial tubercles can be of value to systematic studies. Similarities and differences in behaviour patterns from which relationships can be inferred. The three primary functions attributed to nuptial tubercles as listed by Wiley and Collette are: maintenance of body contact between the sexes during spawning; defence of nests and territories; and stimulation of the females in breeding. No doubt the spawning behaviour of *O. quathlambae* will when known, give meaning to the development described above and, in conjunction with similar studies on other species, shed more light on the relationships of this interesting species.

Although the degree of development or patterns of distribution of nuptial tubercles have not been considered in southern African cyprinid taxonomy, certain species have been separated using as a major character the presence or absence of such tubercles (Barnard, 1943; Jubb, 1967). Because nuptial tubercles develop concurrently with the breeding season caution is necessary when considering the use of tubercles in taxonomic studies. For example the difference between *Barbus anoplus* and *B. motebensis* rests largely on the absence of nuptial tubercles in breeding males of the former species and their presence in the latter. However recent indications suggest that only a single polymorphic species is involved and that a specific distinction on the basis of nuptial tubercles is doubtful (Jubb. pers. comm.).

Similarity of red fin flashes in *O. quathlambae* with the "red fin" group of *Barbus* species from the southern and south-western Cape Province of South African might suggest some relationship. However the red flashes of *O. quathlambae* are unlike those of the "red fin" *Barbus* species in that they do not impinge on the fin membranes. Red fin flashes are known in many other cyprinid species from widely separated geographical areas—e.g., *Notropis effusus* in North America, *Barbus tetteyi* in Sri Lanka (Ceylon), suggesting that the character has some functional significance. Thus it is likely that the red fin flashes have evolved separately on different occasions. However this does not preclude a relationship between *O. quathlambae* and the "red fin" *Barbus* species, and further investigations particularly to elucidate the significance of the red fins, is necessary.

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